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the logical development of a system is one thing, its critical evaluation a second and distinct problem.

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A SIMPLE METHOD FOR THE STUDY OF ENTOPTIC PHENOMENA

THE introspective examination of the eye is interesting, both in experiments and in classroom work. The general name of entoptics for this subject was suggested by J. K. Listing. The method of studying the interior of one's own eyes, by letting light shine through a small pin-hole held close to the eye, has been carefully developed. Barrett constructed an elaborate instrument on this plan and made some detailed experiments which are reported in the *Proceedings of the Dublin Royal Society,* 1906. That the inside of the eye can be illuminated by the light reflected from a bright surface held close to the eyeball has been frequently mentioned, but the possible improvements in method that this fact provides have not been developed so far as I am aware, nor have their great advantages been appreciated.

A very simple and very effective apparatus for becoming acquainted with some of the characteristics and phenomena of one's own eye is provided by small silver beads strung on a wire in a spectacle frame. From the standpoint of psychology, perhaps the most important use of such an instrument is in the study of the movements of the iris.[1] If, for instance, three beads are strung for each eye on a wire adjusted to the spectacle frame so that they are horizontal just below or perpendicular to one side of the pupil, they will throw three circles of light upon different parts of the retina of each eye. For some experiments it is well to cover the frame with black cloth, allowing the beads to show through a slit. The beads may be moved back and forth and the intensity of the light increased or diminished by approaching it or removing from it until the middle circle is exactly tangent to the two others.

In the first place we have here a means of observing the reflex action of the pupils in both the eyes at the same time. Their coordination may be examined.

In the second place we have a means of measuring quite exactly the enlargement and contraction of the pupil. The middle circle will go over into the field of the other circles or will draw away from them. A scale at a fixed distance from the eye may be used to interpret dimensions objectively.

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[1] Badol reports an instrument to study dilations of the pupil in *Transactions de la Société de Biologie,* 1876. He used a cylinder and two cards with pin-holes. For the study of iris movements from the medical standpoint, see Bumke, ''Pupillenstörungen,'' 1904, and Bache, ''Pupillenlehre,'' 1908.

In the third place and this is an exceedingly important point—the observer may take an easy position, settling back in his chair and permitting everything to fall into a normal condition. Such a condition is hardly possible where the eye is being looked at from the outside.

The reflex movements due to quantity of illumination, to converging movements of the eyeballs, to bodily irritations, and to mental states can be examined at one's leisure. A physician who undertakes to study iris movements in a patient would do well to be familiar with the reflex action in his own eye. Interesting are the changing jerkiness of the continual oscillations, the influence of fatigue, the reaction time, etc. It is noticeable, for instance, that the motion of the circles of light away from the center is greater than that about the macula. Again, the student will probably be surprised to find that, given a certain coordinated dilation with one eye closed, the opening of the closed eye brings about a quick contraction. He might have expected that, as the intensity of the sensation is not increased when objects are seen with two eyes, so the reflex motor effect would not be increased.

The use of a single bead with two or three sources of light moved nearer and farther away enables one to light up surfaces of the retina with different intensities. This different lighting is an advantage when one wishes to compare entoptic shadows falling on the outer portions of the retina with shadows at the center. If the lighting be of the same degree, the central shadows are so much clearer that it is hard to pay attention to those away from the center. The difficulty may be partly overcome by strengthening the illumination which is thrown upon the outer parts of the retina. This advantage becomes quite important when one is trying to locate the position of the bodies which throw the shadows. Those near the center of the lens do not change their respective location on the different circles of light. Those in front move apart and those behind move together.

In my own eye there is a fixed opaque body at about the center of the lens. A body like this enables one to confirm the blind spot. There is also a movable anchored body on the nasal side just back of the lens. I can throw this into the field of vision by a quick movement of the eyeball, and then it will slowly draw back out of sight. If the light be dimmed the iris curtains are drawn away and show it stationary.

These circles of light give indirect information about the place of the veins and arteries that appear upon the retina when a light is moved about just below the pupil. The student will probably be surprised to learn first of all that none of the blood-vessels are made visible when the circles of light are thrown upon the retina from his bead. Our method of studying entoptic phenomena allows a simultaneous combination with Purkinje's experiment. The arbor-like branches will then be seen passing right across the circles of light.

I will mention one more fact observed on using one bead with two lights, which seems to have a rather special psychological interest. If a light of a certain intensity is throwing a circle upon one portion of the retina and another stronger light is turned on to throw a circle upon another portion quite a distance away, there is an immediate dimming of the first circle. The dimming is of such a character as to appear to be entirely a peripheral matter and not due to mental interpretation from contrast. A possible analogy might be the disturbance of one current of electricity by the proximation of a much stronger current.

The same bead arrangement may be used to throw different colors from colored electric light globes upon different surfaces of the retina. These circles may be superposed, the different parts of the retina compared as to color sensation, the effects of contrasts brought out, etc.

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DISCUSSION

ON MIND AS AN OBSERVABLE OBJECT[1]

A PAPER of this same title which I offered a year ago met with a success beyond my expectation. It is something to have aimed at brevity and to be assured one has not missed completeness. Now there are a number of ways in which a theory of mind may be vitally amiss: in its epistemological background, in its psychological application, in its ethical consequences. Yet brief as was my exposition, my critics gave me to understand that I had let none of these ways of going astray escape me.

If then I return to my thesis, if I am led into an insistence neither justified by its merit nor excused by its interest, something

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[1] This paper was prepared to be read before the Philosophical Association at Cambridge; but owing to a misunderstanding on the author's part was presented too late to be included in the program. With this explanation, the paper is offered without change of form.